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Tear Film Dynamics Associated with Contact Lens Wear and Changes in Visual Performance and Reported Contact Lens Comfort

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INTRODUCTION

- Contact lens wear is known to disrupt the tear film causing increased tear evaporation and tear film instability.[1]
- The pre-lens tear film (PLTF) overlying the contact lens is difficult to quantify and there is currently insufficient research that quantifies the PLTF instability.
- The lipid layer of the tear film has a higher index of refraction than the surrounding air and aqueous layer making this interface highly reflective. This allows the lipid layer thickness of the pre-corneal tear film (PCTF) and PLTF to be measured and imaged using interferometry.[2]
- The lipid layer is the most superficial layer of the tear film and contributes to the tear film stability by creating a barrier to evaporation and preventing premature tear breakup.[3]
- Recent evidence supports the theory that a thin, variable lipid layer over the ocular surface creates non-uniform evaporation of the tear film ultimately leading to tear breakup.[4,5]
- The CLDEQ-8 is a validated questionnaire used to assess the subject's frequency and intensity of discomfort, dryness, and blurred vision while wearing contact lenses. The CLDEQ-8 is widely used and is recognized as a standard for contact lens assessments.[1]

METHODS

- 5 clinically normal subjects were fit into 2 contact lens designs, delefilcon A and etafilcon A.
- Lipid layer thickness measurements of the PCTF were acquired using the King-Smith Stroboscopic Video Color Microscope prior to lens insertion.
- The PLTF was assessed 15 minutes after lens insertion and after 6 hours of lens wear.
- High and low contrast logMAR acuities were measured at each time interval.
- The CLDEQ-8 was administered at each time interval to assess contact lens comfort.
- Average lipid layer thickness and logMAR acuity were averaged between the right and left eye and compared using paired t-tests. The CLDEQ-8 scores at the 15 minute and 6 hour time intervals were compared using paired t-tests.

AIM

- **To evaluate the use of ocular surface imaging on pre-corneal tear film (PCTF) and pre-lens tear film (PLTF) dynamics associated with contact lens wear.**
- **To quantify changes in the PLTF on contact lens surfaces differing in material composition.**
- **To assess possible visual effects of PLTF changes during the course of a 6-hour period using high and low contrast visual acuity.**
- **To assess changes in reported contact lens comfort during the course of the 6 hour wearing cycle.**

RESULTS

CLDEQ-8 Scores	15 Minutes	6 Hours
etafilcon A	5.00 ± 6.78	10.8 ± 9.88 (p = 0.07)
delefilcon A	8.8 ± 4.92	9.8 ± 10.59 (p = 0.74)

Change in Lipid Layer Thickness After 6 hours of Contact Lens Wear	Baseline PCTF → 6 hours	15 minutes → 6 hours
etafilcon A	-9.6 ± 13.8 nm (p = 0.19)	-9.2 ± 14.8 nm (p = 0.24)
delefilcon A	-6.2 ± 7.7 nm (p = 0.14)	-3.0 ± 7.9 nm (p = 0.44)

LogMAR Visual Acuity	High Contrast	Low Contrast
etafilcon A	15 min: -0.113 6 hour: -0.096	15 min: 0.094 6 hour: 0.196*
delefilcon A	15 min: -0.108 6 hour: -0.063	15 min: 0.110 6 hour: 0.168

**Significant decrease in low contrast acuity, 0.10 ± 0.6 (p = 0.02), in etafilcon A after 6 hour of contact lens wear.*

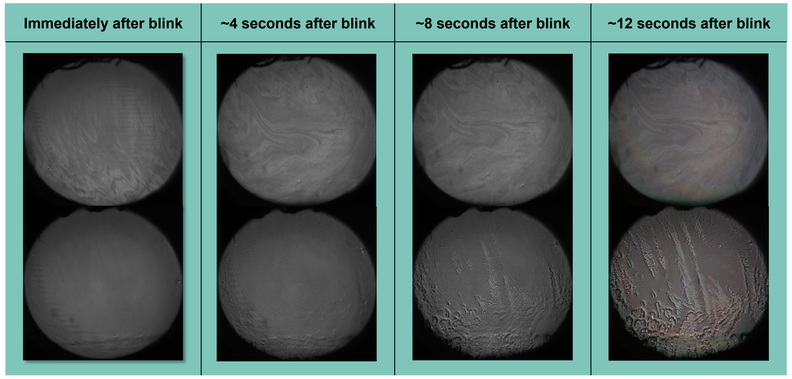

Figure 1: Etafilcon A (top series) and delefilcon A (bottom series) after 6 hours of wear.

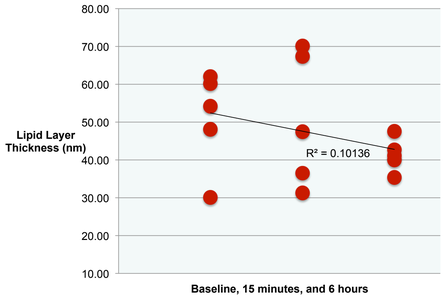

Figure 2: Change in lipid layer thickness from the PCTF to PLTF after 15 minutes and 6 hours of contact lens wear of 5 subjects in etafilcon A.

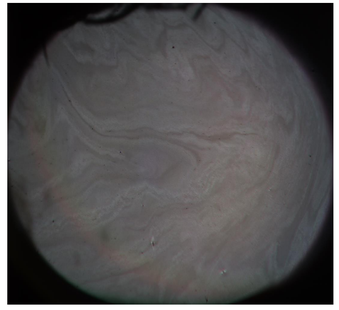

Figure 3: Etafilcon A after 6 hours of wear. Frame taken after prolonged exposure without blinking (~12 sec).

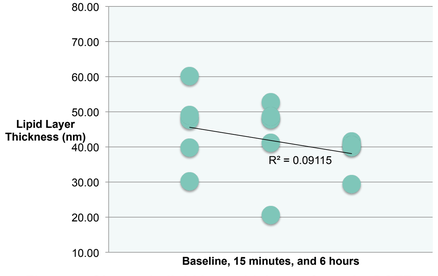

Figure 4: Change in lipid layer thickness from the PCTF to PLTF after 15 minutes and 6 hours of contact lens wear of 5 subjects in delefilcon A.

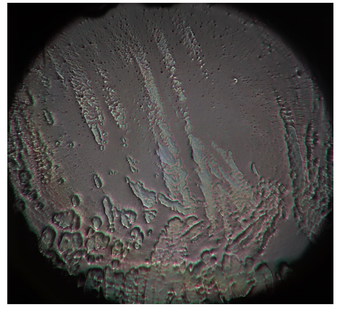

Figure 5: Delefilcon A after 6 hours of wear. Frame taken after prolonged exposure without blinking (~12 sec).

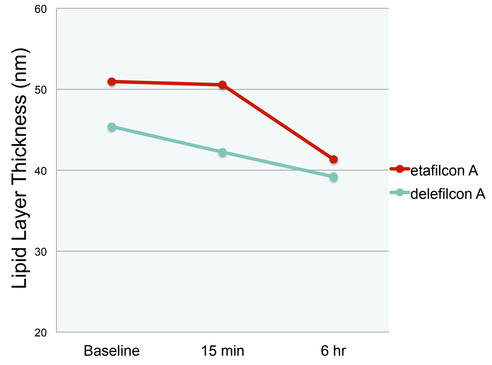

Figure 6: Change in lipid layer thickness from the PCTF to the PLTF after 15 minutes and 6 hours of contact lens wear.

CONCLUSIONS

- Ocular surface imaging is useful in assessing tear film dynamics associated with contact lens wear, where quantifiable changes in lipid layer thickness can be identified over the course of a wearing cycle.
- Low contrast acuity may be a more sensitive marker than high contrast acuity for vision changes associated with PLTF dynamics.
- The changes in lipid layer thickness of the PLTF may be associated with differences in reported contact lens comfort.

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